

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

SUBSTITUTE SPECIFICATION UNDER 37 CFR 1.125 (Marked-up Version):

**MULTIPLE CHIPS IMAGE SENSOR PACKAGE MULTI-CHIP IMAGE**  
**SENSOR MODULE**

5

**BACKGROUND OF THE INVENTION**

**Field of the invention**

The invention relates to a ~~multiple chips~~ multi-chip image sensor module, and in particular to an image sensor module having the improved quality and the  
10 reduced volume. ~~the volume of the package.~~

**DESCRIPTION OF THE RELATED ART**

Referring to FIG. 1, a conventional image sensor module includes a lens holder 10, a lens barrel 20, and an image sensor 30. The lens holder 10 has an upper end face 12, a lower end face 14 and an opening 16 penetrating through the  
15 lens holder 10 from the upper end face 12 to the lower end face 14. An internal thread 18 is formed on an inner wall of the opening 16 of the lens holder 10. The lens barrel 20 formed with an external thread 22 is inserted from the upper end face 12 of the lens holder 10, received within the opening 16, and screwed to the internal thread 18 of the lens holder 10. The lens barrel 20 is formed with a  
20 transparent region 24 under which an aspheric lens 26 and an infrared filter 28 are arranged in sequence. The image sensor 30 has a first surface 32 and a second surface 34 opposite to the first surface 32 on which a transparent layer 36 is arranged. The image sensor 30 is bonded to the lower end face 14 of the lens holder 10 through the transparent layer 36. The screwed length between the lens  
25 barrel 20 and the lens holder 10 may be adjusted to control the distance from the aspheric lens 26 of the lens barrel 20 to the transparent layer 36 of the image sensor 30.

The above-mentioned image sensor module has the following drawbacks.

1. Because the image sensor 30 is bonded to the lower end face 14 of the lens holder 10 through the transparent layer 36, the image sensor 30 cannot be replaced when the image sensor 30 of the module is damaged. In this case, the overall module has to be treated as a waste material, and other good elements in the  
5 module may not be recycled.

2. Because the transparent layer 36 is bonded to the lower end face 14 of the lens holder 10 by the adhesive, which may contaminate the surface of the transparent layer 36, poor optical signals may be obtained.

3. When the module is assembled, the transparent layer 36 has to be precisely  
10 positioned with the aspheric lens 26 and then bonded to the lens barrel 20. Once the positional precision deviates from the standard level, the overall module cannot be reassembled and has to be treated as the waste material

4. The lens holder 10 has to be additionally provided to combine the lens barrel 20 with the image sensor 30.

## 15 SUMMARY OF THE INVENTION

An object of the present invention is to provide a ~~multiple-chips~~ multi-chip image sensor module having the advanced test ~~effort~~ effect before being assembled. ~~module.~~

Another object of the present invention is to provide a ~~multiple-chips~~  
20 multi-chip image sensor module having a reduced and miniaturized package volume.

To achieve the above-mentioned objects, the invention provides a multi-chip image sensor module, which includes a first substrate, a photosensitive chip, a lens holder, a lens barrel, an aspheric lens, a transparent layer, a second substrate  
25 and a lower chip. The first substrate has an upper surface formed with a plurality of first connecting ends, and a lower surface formed with a plurality of second connecting ends. The photosensitive chip is arranged on the upper surface of the first substrate, and electrically connected to the first connecting ends by a plurality of first wires. The lens holder is formed with a through hole at a center thereof.  
30 An internal thread is formed on an inner wall of the through hole, and the lens

holder is mounted on the upper surface of the first substrate to encapsulate the photosensitive chip. The lens barrel is arranged within the through hole of the lens holder and formed with an external thread, which is screwed to the internal thread of the lens holder. The lens barrel is formed with a chamber and an opening communicating with the chamber. The aspheric lens and the transparent layer are placed within the chamber. The second substrate has a first surface on which a plurality of signal output ends are formed, and a second surface on which a plurality of signal input ends are formed. The first surface of the second substrate is mounted on the lower surface of the first substrate, and then the signal output ends are electrically connected the second connecting ends of the first substrate. The lower chip is located on the second surface of the second substrate and electrically connected to the signal input ends of the second substrate.

~~a first substrate, which have a upper surface and a lower surface, the upper surface is formed with a plurality of first connected ends, the lower surface is formed with a plurality of second connected ends. A photosensitive chip is arranged at the upper surface of the substrate, and is electrically connected the first connected ends by a plurality of wires. A lens holder is formed with penetrate hole at a central thereof, an internal thread is formed on the inner wall of the penetrate hole, the lens holder is mounted on the upper surface of the first substrate to encapsulate the photosensitive chip. A lens barrel is arranged within the penetrate hole of the lens holder and is formed with an external thread, which is screwed to the internal thread of the lens holder, the lens barrel is formed with a chamber and an opening communicating the chamber. An aspheric and transparent layer are placed within the chamber. A second substrate is formed with a first surface on which a plurality of signal output ends are formed, and a second surface on which a plurality of signal input end are formed. The first surface of the second substrate mounted on the lower surface of the first surface, then the signal output end are electrically connected the second ends of the first surface. And a chip located on the second surface of the second substrate and is electrically connected to the signal input ends of the second substrate.~~

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view showing a conventional image sensor module.

FIG. 2 is an exploded cross-sectional view showing ~~multiple chips a~~  
5 multi-chip image sensor module of the present invention.

FIG. 3 is a cross-sectional view showing ~~multiple chips the multi-chip~~ image sensor module of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 2 and 3, ~~FIG3, a multiple chips a~~ multi-chip image  
10 sensor module of the present invention includes a first substrate 40, a photosensitive chip 42, a lens holder 44, ~~a a~~ lens barrel 46, a second substrate 48 and a chip 50.

The first substrate 40 has an upper surface 52 and a lower surface 54, the upper surface 52 is formed with a plurality of first ~~connected~~ connecting ends 56,  
15 and the lower surface 54 is formed with a plurality of second ~~connected~~ connecting ends 58.

The photosensitive chip 42 is arranged ~~at-on~~ the upper surface 52 of the substrate 40, and is electrically connected to the first ~~connected~~ connecting ends 56 of the substrate 40 by a plurality of wires 60.

20 The lens ~~holder46-holder~~ 44 is formed with ~~penetrate-hole a~~ through hole 62 at a ~~central-center~~ thereof, an internal thread 64 is formed on the inner wall of the ~~penetrate-hole~~ through hole 62, and the lens ~~holder46-holder~~ 44 is mounted on the upper surface 52 of the first substrate 40 to encapsulate the photosensitive chip 42.

The lens barrel 46 is arranged within the ~~penetrate-hole~~ through hole 62 of  
25 the lens ~~holder46-holder~~ 44 and is formed with an external thread 66, which is screwed to the internal thread 64 of the lens ~~holder46-holder~~ 44, and the lens barrel 46 is formed with a chamber 68 and an opening 70 communicating with the chamber 68. An aspheric lens 72 and a transparent layer 74 are placed within the chamber 68.

30 The second substrate 48 is a flexible/hard combination board, which includes

a flexible board\_78 and a hard board\_76. The second substrate\_48, ~~which includes is form~~ has a first surface\_80 on which a plurality of signal output ends\_84 are formed, and a second surface\_82 on which a plurality of signal input ends\_86 are formed. The first surface\_80 of the second substrate\_48 is mounted on the lower surface\_54 of the first ~~surface~~40 substrate 40, and then the signal output ends\_84 are electrically connected the second connecting ends\_58 of the first ~~surface~~40 substrate 40. And

The chip\_50 is a signal processor, which is located on the flexible board 78 of the second substrate\_48 and is electrically connected to the signal input ends\_86 of the second substrate\_48 by wires\_88. A resin layer 90 for encapsulating the chip 50 is also provided.

The ~~multiple chips~~ multi-chip image sensor module of the present invention has the following advantages.

1. Since ~~multiple chips~~ the multi-chip image sensor module of the present invention may test and package the chip and module in the different time periods and, then assemble the chip and module, ~~so that it may enhance the quality may be enhanced.~~

2. Since the lens holder is directly arranged at-on the first substrate\_40, so it is possible to make the invention have ~~prevent invent has~~ a reduced and miniaturized package volume.

While the invention has been described by way of an example and in terms of a preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiment. To the contrary, it is intended to cover various modifications. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications.

Appl. No. 10/705,379  
Amdt. dated July 10, 2007  
Reply to Office action of 04/17/2007

**WHAT IS CLAIMED IS:**

ABSTRACT OF THE DISCLOSURE

A ~~multiple-chips~~ multi-chip image sensor module includes a first substrate; ~~□~~  
a photosensitive chip ~~is arranged at the~~ on an upper surface of the first  
substrate; ~~□~~ a lens holder ~~is~~ mounted on the upper surface of the first substrate to  
5 encapsulate the photosensitive chip; ~~□~~ a lens barrel ~~is~~ arranged within the lens  
holder and ~~is~~ formed with a chamber and an opening communicating with the  
chamber; ~~□~~ an aspheric lens and a transparent layer placed within the chamber; ~~□~~  
a second substrate ~~is~~ mounted on the first substrate and ~~is~~ electrically connected to  
the first substrate; ~~□~~ and a lower chip located on ~~the~~ a second surface of the second  
10 substrate.